

Composition of Seams in Cheddar Cheese

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Abstract

The material comprising the obvious light-colored seams in some Cheddar cheeses now commercially available was analyzed *in situ* and after isolation. From the data obtained, it was concluded that the seam material contained primarily whey proteins, slightly elevated levels of chloride, calcium and phosphate. Some fat was also present but was not studied. The seam area is characterized by a pH approximately one unit higher than the bulk cheese. The ratio of calcium to phosphate indicates that it may be present in the form of calcium orthophosphate.

Composition of Seams in Cheddar Cheese

The light-colored seams appearing in some aged Cheddar cheeses being sold in local supermarkets were recently investigated in our laboratory. These seams are formed along the junctions of the milled curd particles after pressing and do not disappear during the aging process. The condition is regarded as a defect, not only because of the uneven color but because the cheese tends to crumble and dry out along these junctions when sliced. The results of a series of qualitative and quantitative tests designed to give information concerning the chemical nature of the seam material are presented below and considered in the light of a recently published paper concerning the composition of seams appearing in some Cheddar cheeses now being produced in Australia.

Experimental Procedure

Several simple qualitative tests were run to gain information pertaining to seam composition and structure. In these tests, a freshly cut surface of the cheese was pressed with acid washed filter paper impregnated with suitable solutions and the material preferentially leached from the seam zone was characterized using the appropriate reagents.

The electrical resistance of the cheese along, across and away from the seams was determined using a small probe type conductivity cell and an Industrial Instruments, Inc. conductivity bridge, Model RC 16B2. All measurements were made in the center of the slice since

higher readings were noted near the drier outside edges of the cheese slice.

Quantitative information concerning its composition was obtained by isolating approximately 100 mg of the seamy material by microdissection. The extracted material was then dispersed in a small amount of veronal buffer, pH 8.4. The concentration of the proteins extractable by veronal was then determined by measuring their fluorescence in the ultraviolet region as described by Fox, et al. (3). The principal proteins present were determined in acrylamide gels by use of a Canalco disc electrophoresis apparatus, Model 12 system. Calcium was determined by back titration after addition of excess ethylene-diamine-tetraacetate (4), and phosphate by the formation of phosphomolybdic acid followed by reduction with 1-amino-2-naphthol-4-sulfonic acid (2). The fraction of the isolated seam material soluble in 0.1N HCl was used for these analyses.

Exact quantitative analysis of the fat and water content of the isolated material was impossible due to the microdissection technique employed.

Results and Discussion

Figure 1 is a typical view of the seam zone under low power magnification. It is apparent from our observations that the seams are essentially colorless, dense and discontinuous in nature, variable in width and variable in the extent to which they are fused to the body of the cheese. This unique material appears to be granular but we were unable to detect any crystalline material in the seam area.

Table 1 shows resistances measured along and across the cheese seams as well as in the bulk cheese. The measured resistances were relatively uniform, indicating that the ion distribution is equal and continuous throughout the cheese. A small but real increase in the resistance along the seam, however, may result from

TABLE 1
Electrical resistance of the cheese seams

Sample	Bridge reading* (Ohms)
Bulk cheese	645
Along seam	690
Across seam	693

* Average—6 readings.

Received for publication April 9, 1966.

incomplete fusion along the seam or the presence of less readily ionizable material in the seam proper.

When a filter paper wet with a universal pH indicator (Gramercy) was pressed against the freshly sliced surface of the cheese, it was ascertained that the pH of the seams was approximately 6.5, at least one pH unit higher than the more acid bulk cheese.

Silver chloride, deposited on a filter paper wet with a weak solution of silver nitrate after repeated leaching of the face of the cheese slice, was darkened by the action of light. This revealed that the seams contained either a slightly higher chloride concentration than the bulk cheese or that the chloride was more readily diffusible from the seam.

When a filter paper wet with veronal buffer was pressed onto the cheese surface, and then stained with a methanolic solution of bromphenol blue, it was found that the seams contained proteins more readily soluble in veronal than those found in the bulk cheese. Disc electrophoresis of the veronal soluble fraction of the isolated material showed these proteins to be chiefly whey proteins with only traces of casein present.

Table 2 shows the results obtained when the calcium and phosphate contents of the acid soluble material were determined. The ratios indicate that the seams contain more calcium than the bulk cheese, possibly in the form of calcium orthophosphate. The last column of the table indicates that the seams contain much

TABLE 2
Ratio of constituents in seamy cheese

Sample	PO ₄ /Ca	Salt ^a /Protein
Bulk cheese	2.20	.05
Cheese seams	1.92	4.20

^a Salt = Ca + PO₄ only.

more inorganic material than the bulk cheese. This finding is similar to results published by Conochie and Sutherland (1). They describe the presence of calcium orthophosphate in the seams of Australian cheese made by use of a semi-automated procedure involving mechanical salting of the curd.

From the data obtained, we concluded that the seams contain fat, whey proteins, calcium orthophosphate and slightly elevated levels of chloride. The light color of the seam may result from a possible shift in dye color with increasing pH along the seam or exclusion of the dye due to changes in solubility occurring with the pH shift. All these effects may arise from insufficient washing of the curd prior to salting, as suggested by Conochie and Sutherland, or to the ion exchange of calcium for sodium on the curd surface during the salting process.

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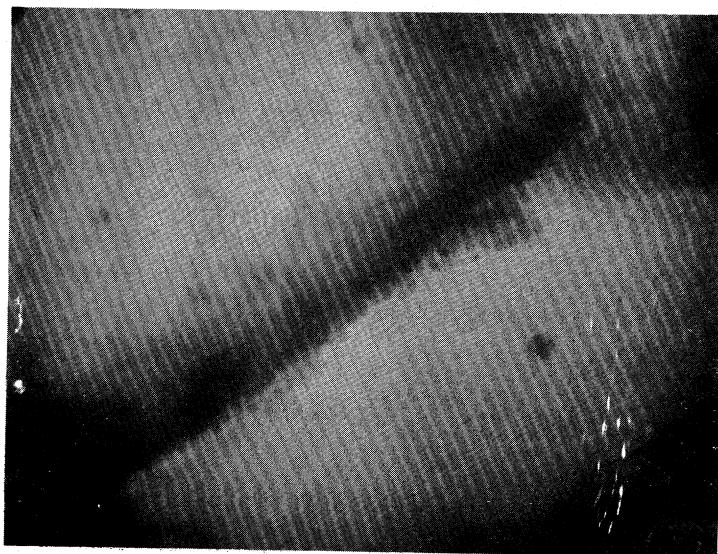


FIG. 1. Photomicrograph of a typical cheese seam using Polaroid Film, Type 42 and a Bausch and Lomb microscope equipped with a 3.5X objective and a 10X eyepiece.

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References

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